Quantitative Research Project

Final Draft

Topic: Anchoring effect - Sai Krishna

Abstract

In this research project we will look at how the anchor effect is used by the retail markets to move their product and motivates the consumers to end coughing up more than what they had initially planned to. And also, how consumers end up buying more quantity than what they had initially planned to when they had visited the store. We try to find the anchor effect on the consumer willing to buy a product by sharing a gamified survey created on the Study Crafter application asking real world consumers if or not they are willing to spend a few more bucks on a better offer related to the initial product they wish to buy. We gather the survey data from two groups of consumers, one of them will be the control group which is exposed to an arbitrary shop environment to establish baseline data regarding purchasing behaviors, while the experimental group will be exposed to the same environment with additional price information designed to create an anchoring bias. We then perform a chi-squared test to test for the difference between the two groups of consumers and how the anchor effect influences the experiment group on their purchase of an item and check if or not the anchoring effect influences consumer decision while choosing a product.

Introduction

The systematic influence of initially presented numerical amount values on succeeding sets of assumptions on unsure quantities, even when presented numbers are obviously unpredictable and therefore missing out any realistic relevancy is referred to as an anchoring effect. In other words, anchoring effect is the way of thinking and perceiving the world that does not necessarily reflect reality. It describes the common human tendency to rely heavily on the first piece of information

offered when making decisions. When making a decision, a person faces anchoring when they are provided with an initial piece of information to make future judgments. When in a situation with multiple options to choose and limited resources, people often use an anchor or focal point as a reference or starting point to create a framework or baseline for sound decision making. Psychologists have found that people have a tendency to rely too heavily on the very first piece of information they learn, which can have a serious impact on the decision they end up making.(1) In psychology, this is a type of cognitive bias which is known as the anchoring bias or 'Anchoring effect'.

Information that aligns with the anchor tends to be assimilated toward it, while information that is more dissonant or less related tends to be displaced. Thus, creating a bias when interpreting and estimating future information by using this anchor to gauge that estimate or projection. Anchoring effect is so widespread and can be seen being used in different applications and is highly appreciated by the corporate world. In a few scenarios even unconvincing anchors end up affecting simple judgments, as we'll try to give reasons as long as we get the sense that we got a real bargain of a product. However, it appears to be true that the relation between size of the anchoring effect and anchor distance is arcuated. Meaning, moderate anchors always tend to lead stronger effects in comparison with extreme ones (6). The larger effect was observed for anchors set above, in comparison to anchors set below the correct answer (3,4,5). The main aim of this research was to determine how the anchor effect influences people on purchase of an item when the actual price is modified by using sale offers.

Related Work

"People make estimates by starting from an initial value that is adjusted to yield the final answer," explained Amos Tversky and Daniel Kahneman in a 1974 paper.

"The initial value, or starting point, may be suggested by the formulation of the problem, or it may be the result of a partial computation. In either case, adjustments are typically insufficient. That is, different starting points yield different estimates, which are biased toward the initial values."

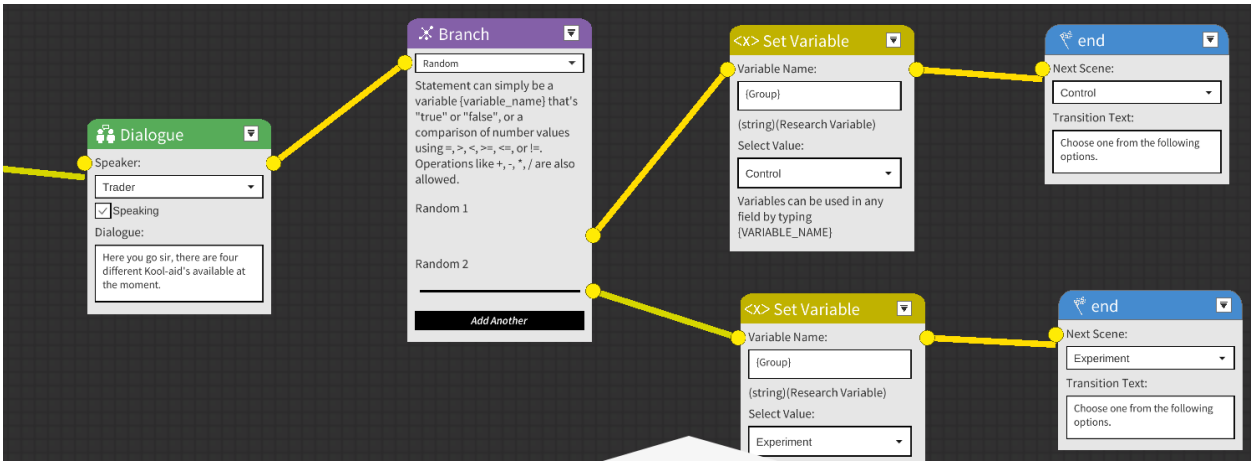
Tversky and Kahneman found that even arbitrary numbers could lead participants to make incorrect estimates.(2)

“Finding the actual willingness to pay for various consumer goods can be manipulated by an uninformative anchor, replicating Ariely et al. (2003). Furthermore demonstrating that the anchoring effect decreases but does not vanish with higher cognitive ability.” -Anchoring and cognitive ability-Authors Oscar Bergmana, Tore Ellingsen and Magnus Johannesson.

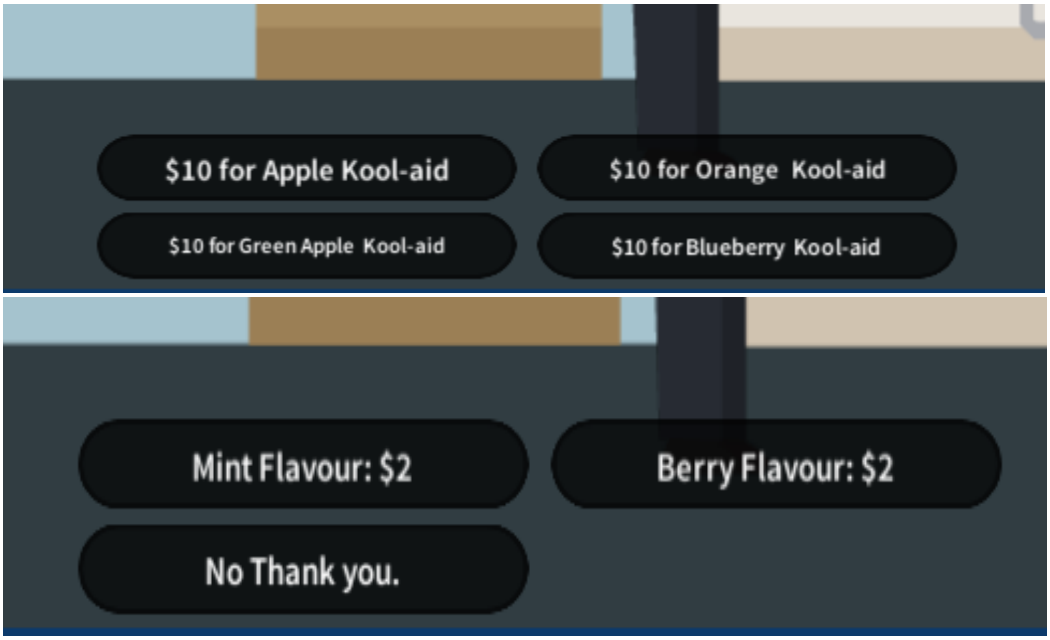
Research trying to seek remedy of methodological shortcomings of foregoing research by employing modified within-subject anchoring procedure-Individual Differences in Anchoring Effect: Evidence for the Role of Insufficient Adjustment - Author Visokog Stevana 2, 11000 Beograd, Serbia.

Method

The research method of this paper aims to get a view on how anchor effect plays a key role in marketing strategies used by the retailers to move their product. I have produced a gamified survey using the StudyCrafter application to help gather the thoughts of real world consumers. The survey's objective is to divide the participants into two groups randomly, the control and experiment groups. This division was achieved using the random function in the StudyCrafter application.

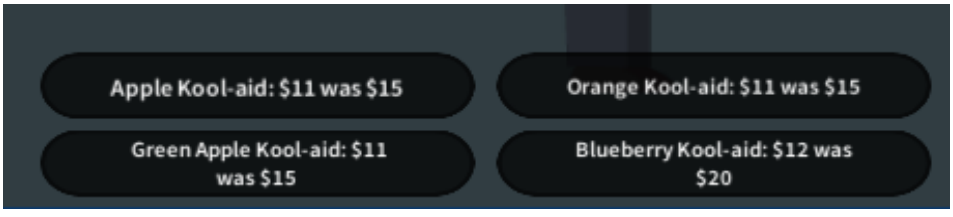


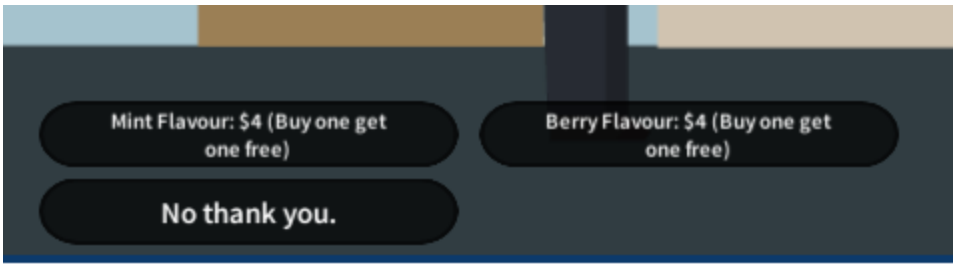
For the control group survey, the participants are shown a fixed variety of kool-aid drinks with fixed prices they can choose from and thus least likely to be biased by the anchor effect and are free to choose a kool-aid of their choice independent of other variables. The control group in the survey will record the percentage of participants purchasing the blueberry kool-aid at list price which will be anchored in the experiment group at offered price.



And for better understanding of anchoring effect influence on customers, I have added another product which the participants can either choose or not choose to buy. The percentage of participants purchasing their choice of gum at list price will be compared with the anchored bundle product in the experiment group.

On the other end, the experimental group will attempt to introduce an anchoring point for the overpriced item, by showing a higher price as the list price and original price as an increased version of it as follows.





We use the following hypothesis to receive the data from the StudyCrafter:

X = 'Anchoring Effect' is an observable phenomenon in retail market environments.

If P >= 1,

Then X= 1,

and

F(X)= F(P),

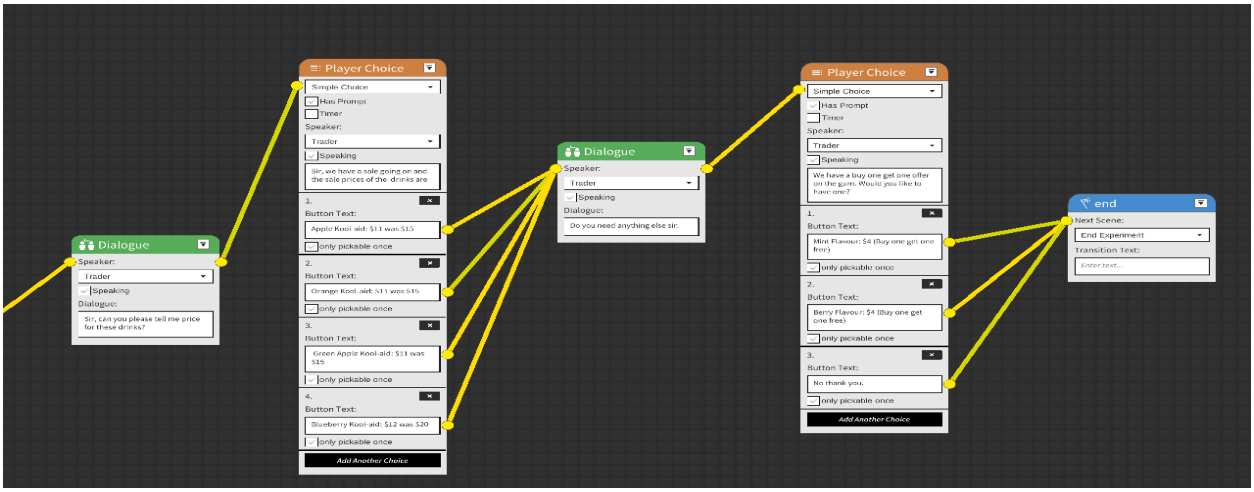
Where P is the difference between % of purchases of the Blueberry Kool-aid item in the control group versus that in the experimental group.

As the participants are being exposed to two different simulated environments using the StudyCrafter to extract data regarding their decision making behaviors in both environments individually.

For the set of control participants, we have provided them with two simple choices to make in the gamified survey and the script used for these participants in Studycrafter is as follows:

We can see from the script that the participant should initially make their choice among a set of assorted kool-aid and gum options. We are trying to obtain the percentage of participants choosing the blueberry kool-aid compared to other options when they are not under the influence of any other variables to affect their freedom of choice.

Contrasting to this we use the following script for the experimental group of participants where they are being influenced by the sale factor and calculate the percentage of participants who choose the blueberry kool-aid under anchor influence.



In other words the control group is being exposed to an arbitrary shop environment to establish baseline data regarding purchasing behaviors, while the experimental group will be exposed to the same environment with additional price information designed to create an anchoring bias; in order to obtain comparative data. Our research is to check if or not the consumers are more likely to purchase a seemingly overpriced item when an anchoring point is given to them with the intention of creating awareness about the base price.

Analysis

We have used the Chi-square statistic tool which was designed to analyze group differences obtained when the choices made by two groups(dependent variable) are measured at a nominal level.We use the Chi-square test from other non-parametric statistics as it is robust with respect

to the distribution of the data. And also because this test does not require equality of variances among the study groups in the data. Computing the Chi-square test provides considerable information about how each of the groups performed in the study. Chi-square test performs the evaluation of both the varying independent variables and of multiple group studies. This richness of detail allows better understanding of the results and derives more detailed information from this statistic than from many other non parametric tools.

Therefore the reasons behind choosing the Chi-square test include its robustness with respect to distribution of the data, its ease of computation, the detailed information that can be derived from the test, its use in studies for which parametric assumptions cannot be met, and its flexibility in handling data from both two group and multiple group studies. But the Chi-square test has a few limitations which include its sample size requirements, difficulty of interpretation when there are large numbers of categories in the dependent or independent variables.

Results

The statistical analysis for this research was done using the StudyCrafter and RStudio. The gamified survey made with StudyCrafter had over fifty participants. These participants were divided randomly into two groups namely the control group and experimental group.

The quantitative study of anchor effects used by retailers on the customers is calculated based on both the independent and dependent variables. The randomness of both the control and experiment groups along with the age of participants stand alone and are not changed by any other variables we are trying to measure in this experiment making them our independent variables. Also, the percentage of purchases of items Blueberry kool-aid and in the control group contributes as an independent variable in the research. Whereas, the only dependent variable in this research is the percentage of purchases of Blueberry kool-aid in experimental groups. Apart from this we double check the anchor effect on the customers from both the groups by asking if the participants in the experiment group are willing to buy a pack of gum anchoring the price of the gum, this is achieved by giving experimental group participants a better offer on the gum but for the same price which is being offered to the control group participants. The obtained

StudyCrafter survey data was analyzed using Rstudio and tested for difference in the two sets of participant choices using the Chi-squared (χ^2 test). We have obtained the following data from the Studycrafter survey from the control and experimental group participants
as follows:

1) Control Group:

Control	Age	Kool-Aid	Gum	Kool-Aid_Final	Gum_Final
1	19	Apple	Mint	1	0
2	21	Orange	Mint	1	0
3	21	Orange	No Thankyou	1	1
4	22	Green Apple	No Thankyou	1	1
5	23	Blueberry	No Thankyou	0	1
6	23	Orange	No Thankyou	1	1
7	25	Apple	No Thankyou	1	1
8	25	Green Apple	No Thankyou	1	1
9	27	Apple	Mint	1	0
10	27	Apple	Berry	1	0
11	27	Orange	No Thankyou	1	1
12	27	Green Apple	No Thankyou	1	1
13	28	Orange	No Thankyou	1	1
14	29	Blueberry	Berry	0	0
15	29	Green Apple	No Thankyou	1	1
16	31	Green Apple	Berry	1	0
17	33	Apple	Mint	1	0
18	34	Apple	Mint	1	0
19	35	Orange	No Thankyou	1	1
20	37	Apple	Mint	1	0
21	39	Green Apple	Mint	1	0
22	39	Blueberry	Mint	0	0
23	39	Green Apple	No Thankyou	1	1
24	39	Apple	No Thankyou	1	1
25	41	Green Apple	No Thankyou	1	1
26	41	Blueberry	Mint	0	0
27	41	Apple	No Thankyou	1	1
28	43	Blueberry	No Thankyou	0	1
29	44	Blueberry	Berry	0	0
30	45	Green Apple	Berry	1	0
31	48	Blueberry	No Thankyou	0	1
32	49	Apple	Mint	1	0
33	51	Blueberry	Berry	0	0
34	51	Apple	No Thankyou	1	1
35	51	Green Apple	No Thankyou	1	1
36	53	Green Apple	No Thankyou	1	1
37	54	Green Apple	No Thankyou	1	1
38	56	Apple	No Thankyou	1	1
39	58	Apple	No Thankyou	1	1
40	59	Green Apple	No Thankyou	1	1
41	61	Green Apple	No Thankyou	1	1
42	71	Apple	No Thankyou	1	1

2) Experimental Group:

Experimental	Age	Kool-Aid	Gum	Kool-Aid_Final	Gum_Final
1	20	Blueberry	Mint	0	0
2	23	Apple	Mint	1	0
3	23	Blueberry	Berry	0	0
4	24	Apple	No Thankyou	1	1
5	24	Blueberry	Mint	0	0
6	25	Green Apple	Mint	1	0
7	25	Blueberry	No Thankyou	0	1
8	28	Apple	Berry	1	0
9	28	Apple	No Thankyou	1	1
10	28	Green Apple	No Thankyou	1	1
11	29	Orange	No Thankyou	1	1
12	29	Blueberry	Mint	0	0
13	29	Blueberry	Berry	0	0
14	32	Green Apple	Mint	1	0
15	34	Orange	Mint	1	0
16	38	Blueberry	Mint	0	0
17	39	Apple	Mint	1	0
18	41	Apple	Mint	1	0
19	41	Green Apple	No Thankyou	1	1
20	43	Apple	Mint	1	0
21	43	Apple	No Thankyou	1	1
22	44	Blueberry	Mint	0	0
23	45	Green Apple	Berry	1	0
24	45	Blueberry	No Thankyou	0	1
25	49	Blueberry	Berry	0	0
26	51	Blueberry	Berry	0	0
27	53	Blueberry	Mint	0	0
28	55	Blueberry	Berry	0	0
29	61	Blueberry	Mint	0	0
30	65	Blueberry	Berry	0	0

The raw data from both the control and experiment groups were then merged into a single dataset which could be used on Rstudio to perform the Chi-squared analysis to find the difference in participant choices in both the groups.

Merged Data:-

Final	Random	Koolaid choice	Gum choice	Age
1	0	1	0	19
2	0	1	0	21
3	0	1	1	21
4	0	1	1	22
5	0	0	1	23
6	0	1	1	23
7	0	1	1	25
8	0	1	1	25
9	0	1	0	27
10	0	1	0	27
11	0	1	1	27
12	0	1	1	27
13	0	1	1	28
14	0	0	0	29
15	0	1	1	29
16	0	1	0	31
17	0	1	0	33
18	0	1	0	34
19	0	1	1	35
20	0	1	0	37
21	0	1	0	39
22	0	0	0	39
23	0	1	1	39
24	0	1	1	39
25	0	1	1	41
26	0	0	0	41
27	0	1	1	41
28	0	0	1	43
29	0	0	0	44
30	0	1	0	45
31	0	0	1	48
32	0	1	0	49
33	0	0	0	51
34	0	1	1	51
35	0	1	1	51
36	0	1	1	53
37	0	1	1	54
38	0	1	1	56
39	0	1	1	58
40	0	1	1	59
41	0	1	1	61
42	0	1	1	71
43	1	0	0	20
44	1	1	0	23
45	1	0	0	23
46	1	1	1	24
47	1	0	0	24
48	1	1	0	25
49	1	0	1	25
50	1	1	0	28
51	1	1	1	28
52	1	1	1	28
53	1	1	1	29
54	1	0	0	29
55	1	0	0	29
56	1	1	0	32
57	1	1	0	34
58	1	0	0	38
59	1	1	0	39
60	1	1	0	41
61	1	1	1	41
62	1	1	0	43
63	1	1	1	43

The data collected is rearranged under four variables. The first row used in analysis is named ‘Random’, it contains the frequency of participants divided into two groups namely the control group noted as ‘0’ and the experimental group noted as ‘1’ in the data table. The ‘Koolaid choice’ row records ‘0’ if the participants chose the blueberry drink, else it records ‘1’ in the data table. Similarly, the third row in the table ‘Gum choice’ records ‘0’ if the participants choose a variety of gum else it records ‘1’ in the table. And the last row in the data set is ‘Age’ which records the participants to further increase the scope of the study by identifying how anchor effect influences different age groups.

After performing the following code on RStudio to perform the chi-squared analysis on the dataset variables ‘Koolaid choice’ and ‘Gum choice’ independently

```
controldata <- read.csv(file="Control.csv")
controldata
experimentaldata <- read.csv(file="Experimental.csv")
experimentaldata
?chisq.test
finaldata <- read.csv(file = "Final.csv")
finaldata
IV <- finaldata$Random
DV <- finaldata$Koolaid.choice

BlueberryChose <- DV[DV==0]
BlueberryNotChose <- DV[DV==1]

Control <- IV[IV==0]
Experimental <- IV[IV==1]
ControlFreq <- length(Control)
ExperimentalFreq <- length(Experimental)
ExperimentalFreq
ControlFreq
BlueberryChoseFreq <- length(BlueberryChose)
BlueberryNotChoseFreq <- length(BlueberryNotChose)
BlueberryChoseFreq
BlueberryNotChoseFreq
datamatrix <- matrix(c(BlueberryNotChoseFreq, ControlFreq, BlueberryChoseFreq, ExperimentalFreq), ncol = 2, byrow = T)
chisq.test(datamatrix)
BV <- finaldata$Gum.choice
GumChose <- BV[BV==0]
GumNotChose <- BV[BV==1]
GumChoseFreq <- length(GumChose)
GumNotChoseFreq <- length(GumNotChose)
GumChoseFreq
GumNotChoseFreq
datamatrix1 <- matrix(c(GumNotChoseFreq, ControlFreq, GumChoseFreq, ExperimentalFreq), ncol =2, byrow = T)
chisq.test(datamatrix1)
```

We obtain the following data matrix for the kool-aid choice which represents there were a total of 42 control group participants and 30 experiment group participants. Of which the frequency of people who chose blueberry kool aid have a higher percentage in the experimental group over the control group participants. We obtain the test statistic as 1.0748 and the degree of freedom/number of classes is 1 and the p value associated with the statistic and degree of freedom is 0.2999. The chi-squared test analyses the Anchoring effect and is seen clearly through the higher percentage of participants purchasing the overpriced item in the experimental group, compared to the control group.

	V1	V2
1	49	42
2	23	30

```
> datamatrix <- matrix(c(BlueberryNotChoseFreq, ControlFreq, BlueberryChoseFreq, ExperimentalFreq), ncol = 2, byrow = T)
> View(datamatrix)
> chisq.test(datamatrix)

        Pearson's Chi-squared test with Yates' continuity correction

data:  datamatrix
X-squared = 1.0748, df = 1, p-value = 0.2999
```

And the data matrix and the chi-squared analysis for the gum choice is as follows and represents that there was a total of 42 control group participants and 30 experiment group participants. Of which the frequency of people who chose to buy a gum in sale have a higher percentage in the experimental group over the control group participants. We obtain the test statistic as 1.3653 and

the degree of freedom/number of classes is 1 and the p value associated with the statistic and degree of freedom is 0.2426. Hence the chi-squared test analyses the anchoring effect again and it can be clearly seen through the higher percentage of participants purchasing the item on offer in the experimental group, compared to that in the control group.

	V1	V2
1	34	42
2	38	30

```
> datamatrix1 <- matrix(c(GumNotChoseFreq, ControlFreq, GumChoseFreq, ExperimentalFreq), ncol =2, byrow = T)
> View(datamatrix1)
> chisq.test(datamatrix1)

        Pearson's Chi-squared test with Yates' continuity correction

data:  datamatrix1
X-squared = 1.3653, df = 1, p-value = 0.2426
```

Discussion

The objective of this research was to find out how the retail markets use different sale promotions on products to influence the consumers that they are getting a good deal on the product. The retailers mostly use the anchor effect on consumers to move their products quickly. According to psychologists, the Anchoring effect is a cognitive bias and can be observed in people who have a tendency to rely too heavily on the very first piece of information they learn, which can have a serious impact on the decision they end up making. To check for this effect on consumers, I have created a gamified survey using the Study Crafter application. This survey was distributed in two formats randomly among the participants. One version of the survey was controlled by and the participants were not influenced by other variables and could freely choose from the available options. On the other hand, participants were under the influence of sale promotions and we analyzed the difference in the percentage of participants choosing a particular product in both the groups to check if or not the participants are influenced by the anchor effect. The survey data includes an additional data row recording the participant age, as age is an independent variable, we can use to further extend our study about anchor effects that influence various age groups. In the current study we divided age into three groups, youth (15-24), adults(25-64), seniors(65 and over). And according to the recordings obtained from the survey, the youth had an irregular choice in both the control and experimental groups making their choice unbiased. The majority of the participants are adults and from the recordings we can

observe that they are highly influenced by the anchor effect and a higher percentage of participants chose the overpriced item in the experimental group when compared with the percentage of control group participants choosing the same item. And the same goes with the senior group of participants. Therefore, from the results we can observe that there is a great percentage of the experimental group participants choosing the overpriced product when compared with the control group participants readings.

References:

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